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Title: SIMULATING FUTURE CHANGES IN THE URBAN HEAT ISLAND EFFECT BASED ON AN INTEGRATION OF SOCIO-ECONOMIC AND CLIMATE SCENARIOS

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Many examples exist of studies that aim to measure the urban heat island effect using different data sources such as satellite images, weather stations and mobile devices. Yet, few studies explain local variation in the observed temperatures and apply this knowledge to downscale global scenarios related to both climatic and socio-economic changes. This paper analyses the strength of the urban heat island effect in a temperate climate, explains local variation in the observed temperatures and quantifies how this urban heat island effect may develop in the coming 30 years due to projected climatic and socio-economic changes. The analysis is based on our own measurement of the urban heat island effect that we define as the maximum temperature difference between local urban temperatures and a rural reference station observed during a 24 hour period.

We describe current urban heat island patterns based on two separate analyses. *Spatial variation* in urban temperatures is measured along a route using mobile measurement devices and then explained using regression analysis and spatially explicit explanatory variables, while *temporal variation* is described based on local temperature measurements derived from amateur weather stations.

To assess potential future changes we build on existing scenario studies and a land-use simulation model. Using observed relations between maximum daily temperatures and observed urban heat island values we are able to assess the impact of climate change on local heat island values. The land-use change model allows the translation of macro-level socio-economic changes into potential future urbanisation patterns and thus the assessment of increased urbanisation on urban heat island effect. Our measurements for the Amsterdam region in the Netherlands show that the urban heat island effect induces maximum temperature differences with the surrounding countryside of over 3 degrees Celsius on moderately warm summer days with a maximum daytime temperature of 20 degrees. The observed temperature difference between urban and rural areas increases by about 0.13 degree for each degree increase in maximum daytime temperature.

The simulations of potential future changes in urban heat island patterns indicate that strong local temperature increases are likely due to urban development. Climate change will, on average, have a limited impact on these changes. Large impacts can, however, be expected from the combination of urban development and potentially more frequent occurrences of extreme climatic events such as heat waves.

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